SMI

Future surface warships 2002

THE TECHNOLOGICAL RESPONSE OF NAVIES TO CRISES

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Outline

- Definition of crisis
- Theses
- Historical examples of crisis and response
- Analysis of trends
- Implications for 21st century navies
- Epilogue: Flexibility

What Constitutes a Crisis?

1. Surprise
2. High probability of involvement in military hostilities
3. Finite time for response
4. Change of the situation is possible

Source: Brecher, Michael. "Toward a theory of international crisis behavior: A preliminary report"
International Studies Quarterly, 21(1):39 - 74, March 1977.

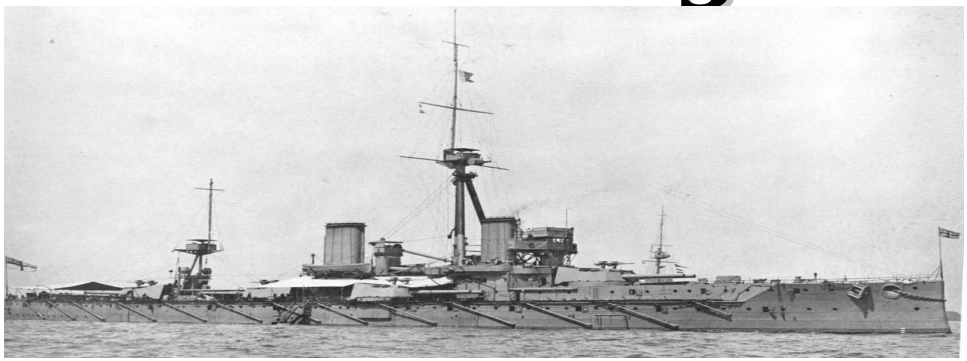
Theses

- Crises generally result in a focus of previously developing technological priorities, not a fundamental shift
- Initial response (finite time): adaptation / improvisation of existing technology
- Long-term response (changing situation) : new technology should be a cooperative effort between military and civilian R&D communities
- Technology is smarter than its inventor
- Success = Technology + doctrine

20th Century Examples

- World War I era
  - Dreadnought
  - Aircraft carrier
- World War II era
  - Anti-submarine warfare
  - Radar
- Cold War and beyond
  - Tomahawk

Dreadnought



- Crisis / threat: High speed, long-range gunnery against Russian and French cruiser fleets
- Emerging priorities: turbines, central fire control, new armor, all-big-gun
- Short-term response: HMS *Dreadnought* synthesized these technologies as “test platform” for battlecruisers

Source: Sumida, John. *In Defence of Naval Supremacy*. 1989

Dreadnought

- Situation change: *Entente Cordiale* + Tsushima means German High Seas Fleet becomes priority
- Long-term response: critical bugs in design fixed in later ships (some by universities); development of doctrine
- Other navies rapidly develop post-*Dreadnought* concepts
- By Sept. *Dreadnought* obsolete, relegated to

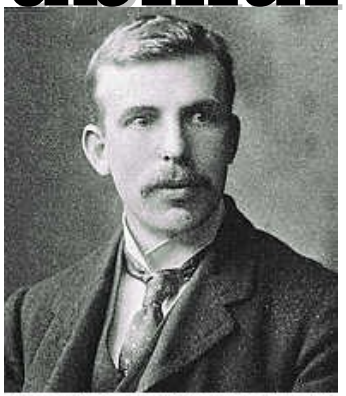
Aircraft Carrier

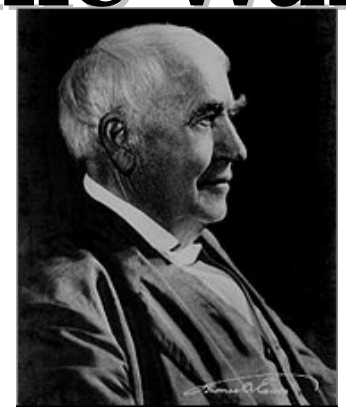
- Crisis / threat : Long-range reconnaissance / scout cruisers
- Emerging priorities: seaplanes, take-off-only decks
- Short-term response: Conversions of HMS *Ark Royal,* HMS *Furious* to fly-off only carriers (later fitted with landing decks)

Aircraft Carrier

- Situation change: Transition of aviation (Army and Navy) from scout-only to strike
- Long-term response: Gradual conversions and experiments of carriers to evolve basic configuration, work out operational bugs and develop doctrine

Anti-Submarine Warfare


Ernest Rutherford (IBM World Book 99)

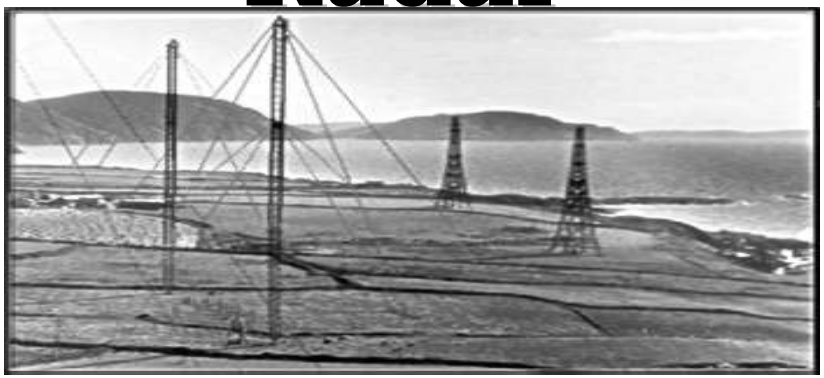


- Crisis / threat : Unrestricted submarine warfare
- Emerging priorities: anti-collision hydrophones; protected zones; anti-submarine barriers
- Short-term response: Civilian boards to evaluate inventions (UK: Board of Invention and Research; USA: Naval Consulting Board; France: Direction des Inventions)
- What worked: Doctrine (convoys, mostly)

Anti-Submarine Warfare

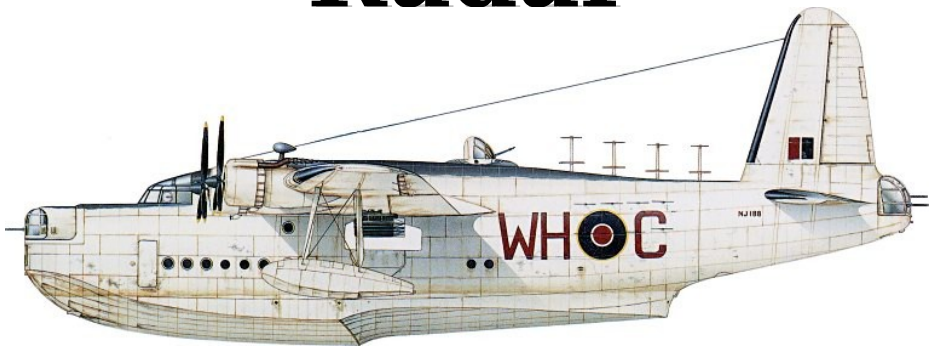
- Situation change: Interwar realization of near-defeat by submarine warfare
- Long-term response: Mobilization of science
  - BIR leads to Admiralty Experimental Works, ASDIC
  - NCB leads to Naval Research Laboratory, NDRC (sonar, radar)
  - Bletchley Park
  - No comparable mobilization of scientists by Central / Axis Powers
- What worked: Technology + doctrine (mostly convoys)

Radar



- Crisis / threat : Allocation of scarce homeland defense resources against attack
- Emerging priorities: radio ranging, central control
- Short-term response: Chain Home (radar technology + command / control doctrine)

Radar



- Situation change: Transition from defense to offense
- Long-term response: Mobilization of scientists; development of cavity magnetron; airborne radar allows ASW, night fighting, all-weather bombing

Tomahawk

- Crisis / threat : Potential of Soviet coordinated strike against aircraft carriers
- Emerging priorities: Anti-ship cruise missiles
- Short-term response: Dispersal of strategic assets by arming surface combatants with nuclear-capable Tomahawks

Source: Friedman, Norman: “Transformation of the US Navy”, *Technology and Naval Combat in the 20th century and beyond*, 2001

Tomahawk

- Situation change: Soviet threat disappears; conventional land-attack role augmented
- Long-term response: Increased use of external information for target selection; networked sensors; tactical targeting
- Basic concepts developing into Net-centric Warfare

Source: Friedman, Norman: "Transformation of the US Navy", *Technology and Naval Combat in the 20th century and beyond*, 2001

Analysis of trends

- Impending crises never a total surprise; appropriate technologies were being developed at time crisis arose
- Initial response often required cobbling-together of immature technologies, combined with innovative uses of others
- Principal difficulties when doctrine had not caught up with technology

(Acknowledgements to Prof. MacGregor Knox, London School of Economics)

Analysis of trends

- Long-term response involved:
  - R&D to solve teething problems and address changes in situation
  - Operational experimentation to iron out doctrine
- Successful navies mobilized civilian scientists in R&D effort
- Technologies evolved in often unforeseen ways, and could disperse very rapidly
- Technology most successful when developed in concert with doctrine

Implications for 21st century navies

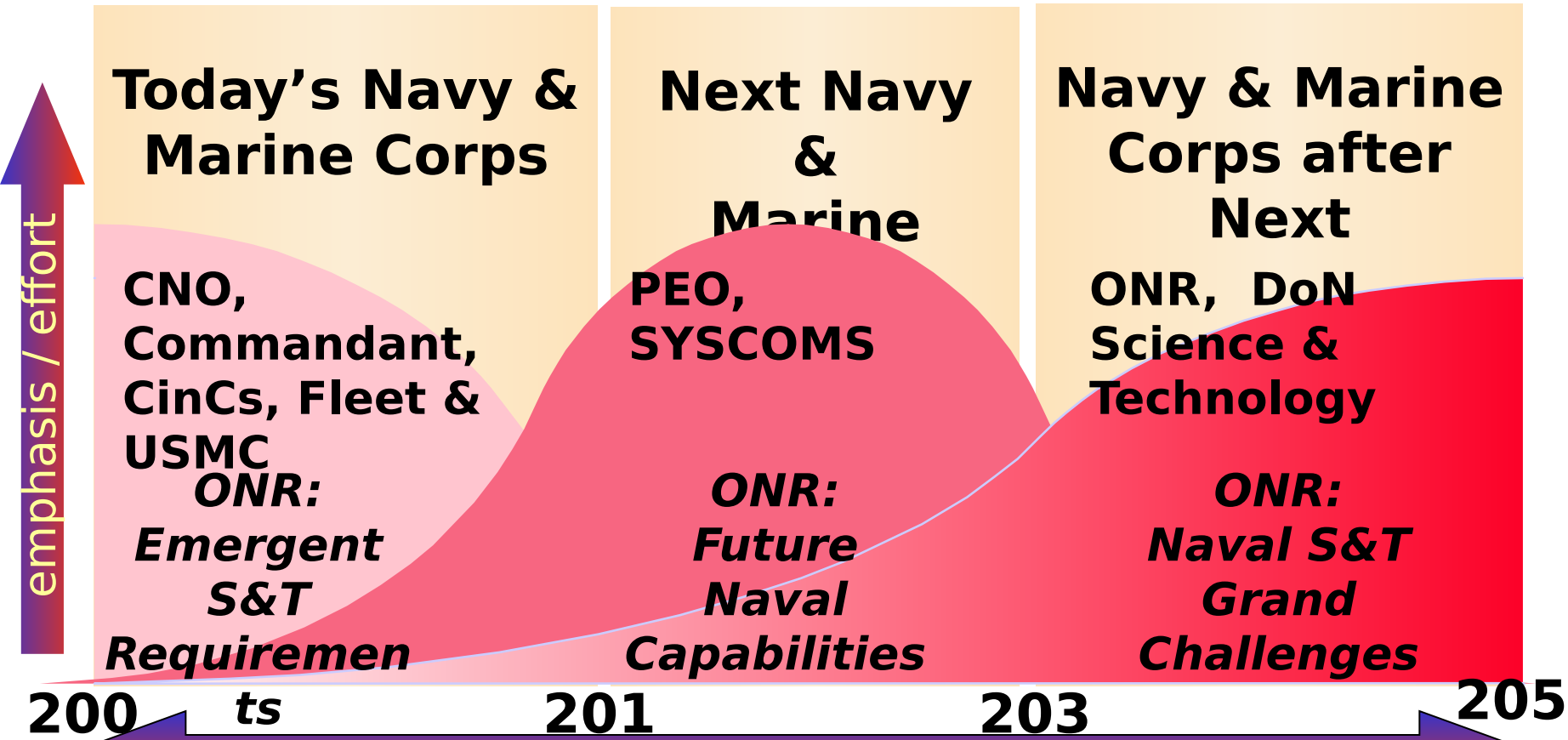
- In the face of a crisis, adapt the technology at hand
- Incremental trial-and-error often the best way to work out the operational bugs
- Cooperation between military and civilian R&D communities opens up the talent pool
- Technology is useful only in what flexibility it provides
- Technologies will always have uses and users unforeseen by their inventors
- Doctrine is always the key

Implications for 21st century navies

- Should 21st century navies invest in basic or applied R&D?
- Studies comparing benefits of the two equivocal
  - Project Hindsight (1965) showed applied R&D far more effective than basic R&D
  - Technology in Retrospect (1968) showed basic R&D provides vital roots for later work
  - Other studies demonstrate that both types have their uses
- Most effective approach is probably a mixture of the two

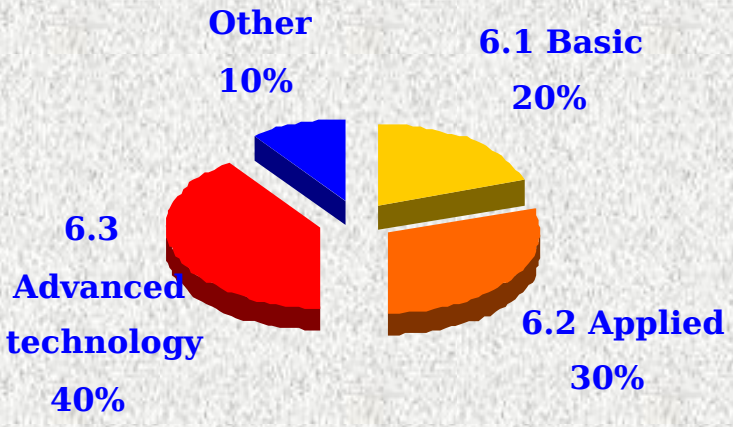
(Source: Sapolsky, Harvey: *Science and the Navy; The History of the Office of Naval Research*, 1990, pp.

How ONR looks at R&D

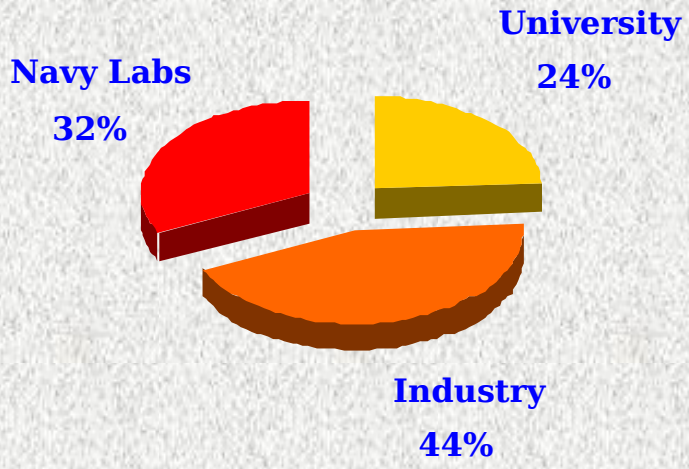


How ONR funds R&D

ONR FUNDING BY TYPE



ONR FUNDING BY ACTIVITY



Epilogue: Flexibility

- 65 years from requirements to scrapping of modern class of ships
- Hypothetical: Requirements of class designed in 1935, ending service 2000, would have had to take into account:
  - WWII
  - Rise of communism as a world power
  - Fall of communism as a world power
  - Satellite communication
  - Elimination of conscription
  - Women at sea
- Flexibility means adaptability to political and social factors as well technological ones

(Acknowledgements: Phillip Sims, NAVSEA)